CLAIMS

I claim

1. An apparatus for forming and delivering a line of shingled sheets comprising:

an in-feed conveyor carrying a line of closely spaced sheets, on a generally planar sheet conveying surface at a first speed;

a shingling section receiving the line of spaced sheets from the downstream end of the in-feed conveyor, said shingling section including a shingling conveyor having a shingle forming and conveying surface, said shingling conveyor operable at a second speed less then said first speed;

a vacuum station separating the in-feed conveyor and the shingling conveyor, said vacuum station including an upstream vacuum chamber having a first vacuum surface defining a first vacuum opening and an adjacent downstream vacuum chamber having a second vacuum surface defining a second vacuum opening;

said first vacuum surface sloping upwardly from an upstream edge positioned below the downstream end of the sheet conveying surface to a downstream edge adjacent the second vacuum surface, said second vacuum surface lying generally parallel to and at or below the plane of the sheet conveying surface of the in-feed conveyor; and,

a vacuum control operable to apply vacuum to the upstream chamber to drop the tail end of each sheet leaving the in-feed conveyor onto the first vacuum surface and to the downstream chamber to decelerate each sheet to said second speed.

2. The apparatus as set forth in claim 1 wherein the upstream edge of said first vacuum surface is adjustably positioned in a range of about 0.5 to 0.75 inch (about 13 to 19 mm) below the sheet conveying surface.

3. The apparatus as set forth in claim 1 wherein said second vacuum surface is adjustably positioned in a range of about 0 to 0.25 inch (about 0 to 6 mm) below the sheet conveying surface.

4. The apparatus as set forth in claim 1 wherein said first vacuum surface is upwardly convex and joins the upstream edge of said second vacuum surface at a generally horizontal tangent.

5. The apparatus as set forth in claim 1 wherein said vacuum control is operable to independently apply vacuum to said upstream and downstream chambers.

6. The apparatus as set forth in claim 1 including an air nip positioned over the shingling conveyor and having a narrow slot extending across the width of the sheets and positioned to direct a thin stream of air against the lead edge of a sheet on the shingling conveyor to nip the sheet on the shingling conveyor during application of vacuum to the downstream vacuum chamber.

7. The apparatus as set forth in claim 6 wherein said air nip is adjustably positionable in the direction of sheet movement.

8. The apparatus as set forth in claim 1 including a snubber wheel assembly positioned over the shingling conveyor and operative to engage the lead edge of a sheet and nip the same on the shingling conveyor during application of vacuum to the downstream vacuum chamber.

9. The apparatus as set forth in claim 6 wherein the snubber wheel assembly is adjustably positionable horizontally in the direction of sheet movement.

10. The apparatus as set forth in claim 1 including a vacuum conveyor belt positioned to operate over said vacuum surfaces at said second speed.

11. The apparatus as set forth in claim 1 including a cam roll positioned between said vacuum surfaces, said cam roll having an inoperative surface portion below said vacuum surfaces and an operative portion rotatable into a sheet engaging position above said vacuum surfaces in response to said vacuum control.

12. The apparatus as set forth in claim 1 including a shingle separating apparatus operatively connected to the downstream end of the shingling conveyor.

13. The apparatus as set forth in claim 12 wherein said shingle separating apparatus comprises:

a shingle separating conveyor;

a shingle holding conveyor;

a vacuum plenum providing an operative connection between the shingle holding conveyor and the shingle separating conveyor, said vacuum plenum having a vacuum opening exposed to a shingle traveling thereover;

a second vacuum control operable to apply vacuum from said vacuum opening to the tail end of a first sheet defining an upstream shingle portion to be separated from a downstream shingle portion; and,

a shingle separating conveyor drive operative in response to said second vacuum control to accelerate said shingle separating conveyor and said downstream shingle portion to a third speed greater than said second speed.

14. The apparatus as set forth in claim 13 including a nip roller apparatus positioned over the shingle separating conveyor and operative in response to said second vacuum control to engage the last sheet of said downstream shingle portion.

15. The apparatus as set forth in claim 13 wherein said shingle separating apparatus includes a shingle holding conveyor providing with said vacuum plenum the operative connection, and wherein said holding conveyor and said shingle separating conveyor comprise belt conveyors, each operating around respective pairs of head and tail pulleys;

a first translating connection including said vacuum plenum interconnecting the holding conveyor head pulley and the shingle separating conveyor tail pulley;

a second translating connection interconnecting the holding conveyor tail pulley and the shingle separating conveyor head pulley; and,

a translation device operable to move said first translating connection downstream at a fourth speed to separate said downstream shingle portion from said upstream shingle portion.

16. The apparatus as set forth in claim 15 wherein said fourth speed is equal to said third speed.

17. A method for shingling a line of sheets delivered in closely spaced orientation from the downstream end of a generally horizontal in-feed conveyor, said method comprising the steps of:

(1) positioning a first vacuum surface to slope upwardly from an upstream edge below the downstream end of the in-feed conveyor to a downstream edge;

(2) positioning a second vacuum surface to extend generally horizontally downstream from adjacent the downstream edge of the first vacuum surface generally coplanar with or slightly below the plane of said in-feed conveyor to a downstream edge;

(3) positioning a generally horizontal shingling conveyor to extend downstream from the downstream end of said second vacuum surface;

(4) operating said in-feed conveyor at a first speed and operating said shingling conveyor at a second speed less than said first speed;

(5) applying a vacuum to said second vacuum surface to decelerate each sheet to approach said second speed

(6) applying a vacuum to said first vacuum surface to drop the tail end of each sheet leaving the in-feed conveyor onto the first vacuum surface; and

(7) controlling the application of vacuum to said first and second vacuum surfaces in response to movement of the tail end of the sheet past each respective surface.

18. The method as set forth in claim 17 including the step of adjustably positioning the upstream edge of said first vacuum surface in a range of about 0.5 to 0.75 inch (about 13 to 19mm) below the infeed conveyor.

19. The method as set forth in claim 17 including the step of adjustably positioning said second vacuum surface in a range of about 0 to 0.25 inch (about 0 to 6 mm) below the infeed conveyor.

20. The method as set forth in claim 17 including the additional steps of:

(1) positioning a shingle separating conveyor downstream of said shingling conveyor;

(2) connecting the upstream end of the shingle separating conveyor to a translating device including a vacuum plenum; and,

(3) operating said translating device to move the shingle separating conveyor and vacuum plenum downstream at a selected speed to separate a downstream shingle portion carried thereon from an upstream shingle portion.